THIRD ANNUAL CONFERENCE
OF THE
WOODS DEPARTMENT

BERLIN MILLS COMPANY
BURGESS SULPHITE FIBRE CO.
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HELD AT BERLIN, NEW HAMPSHIRE
NOVEMBER 23 AND 24, 1915

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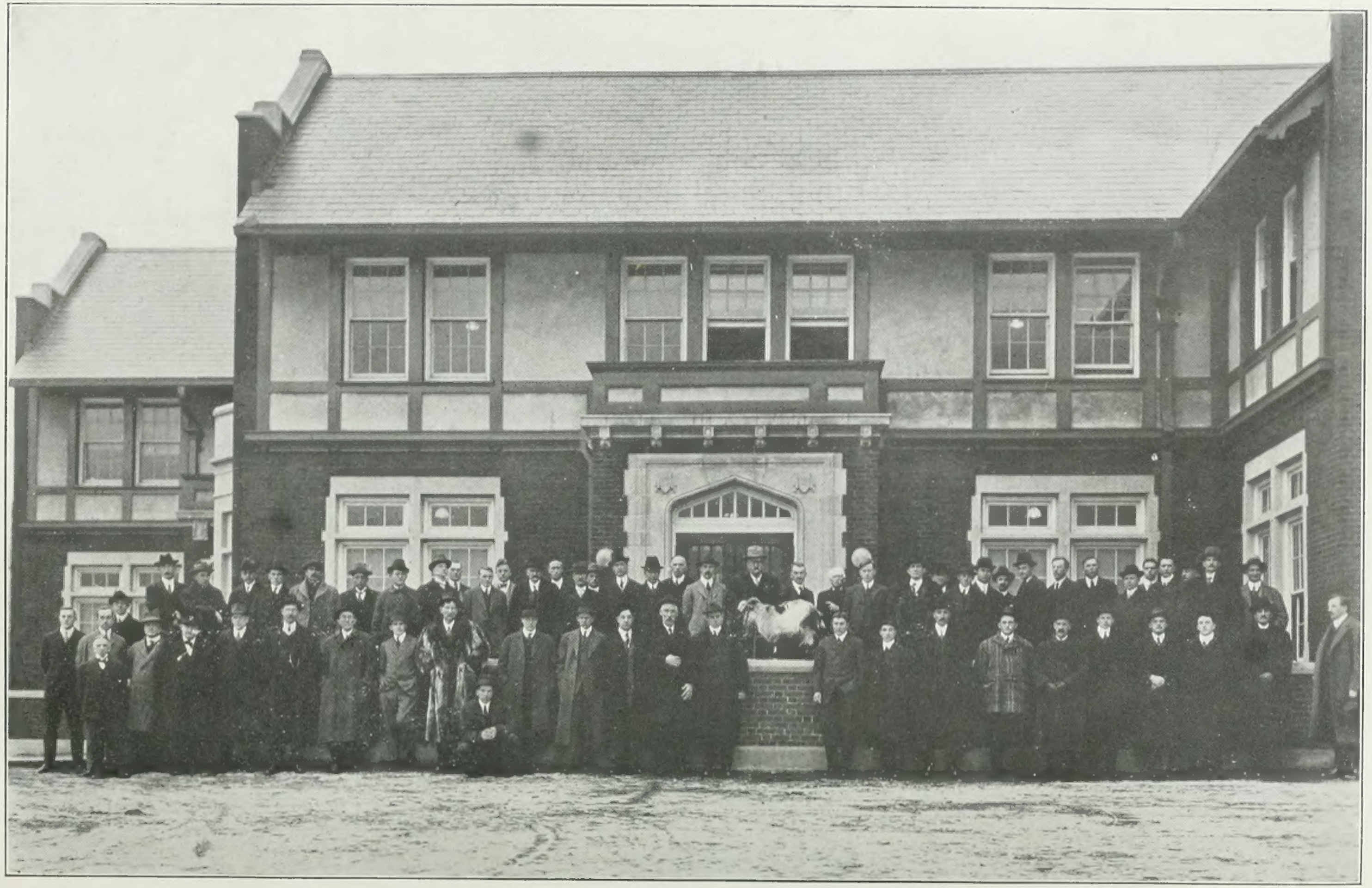
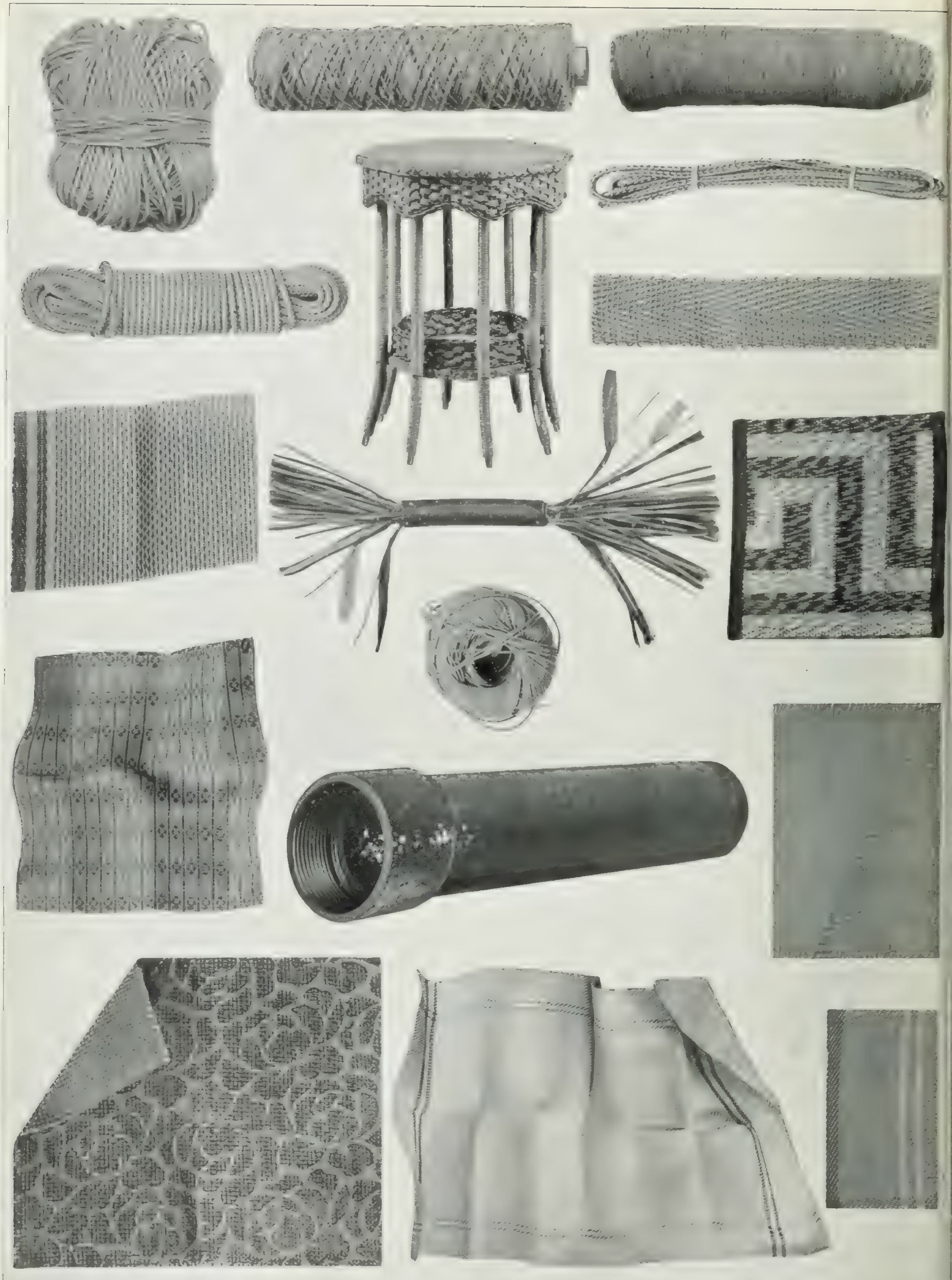


MEMBERS THIRD ANNUAL CONFERENCE
Y. M. C. A. BUILDING, BERLIN, N. H., NOVEMBER 23 AND 24, 1915.

Preface.

The Third Annual Conference of the staff of the Woods Department of the Berlin Mills Company and its American and Canadian subsidiaries was opened Tuesday evening, November 23rd, by a business meeting in the Y. M. C. A. lecture room, Berlin, N. H., at which the papers given in this book were read, those on Kraft Paper, Forest Pathology, Log Hauler and Pulpwood Loading being illustrated by many stereoptican pictures, and the meeting concluded with moving pictures entitled "In the Woods With the American Log Hauler," shown by Mr. Letson of the American Hoist & Derrick Co., and "Logging in Louisiana," shown by Mr. Lumm of the Clyde Iron Works. Mr. W. T. Cox showed samples of and explained the new vegetable cooking fat called Kream Krisp which is being made by hydroginating cotton seed oil in the chemical department, and lately placed on the market as a pure food product to take the place of butter, lard and other cooking fats.

Wednesday morning the members were conveyed to the General Manager's farm for the annual shooting contest between the Americans and Canadians under the supervision of Major O. P. Cole and Lieut. B. H. Hinman. Ranges of one hundred and two hundred yards were used, and the American team proved superior to the Canadian in both. The best individual shooting was done by P. W. Churchill, first; A. L. Bowker, second; and Fred Gilman, third. The American team retained the goat, and F. W. Thompson and J. E. Laffin annexed the two turkeys. George Horn was appointed custodian of the goat for the coming year. A turkey dinner was served at the Y. M. C. A. building and the afternoon was given up to good things to eat, jolly things to say and a general good time for all. W. R. Brown acted as toastmaster, and speeches were had from F. W. Farrington, A. M. Carter, J. J. Lumm, R. J. Sawyer, J. A. Taylor and J. S. Cassidy.



SOME OF THE ARTICLES MADE FROM KRAFT PAPER

Heavy Kraft Twine; Kraft yarn; fancy Kraft rope, spun on hemp core, flag, laundry, window and cable rope of Kraft; rattan filling of Kraft shellacked for table; Kraft webbing for various purposes, overhead and underground high-power copper wire cable insulated with Kraft paper, coarse mattings of Kraft; Kraft Upholstery fabric; Kraft pipe, with thread joint, plain and colored Kraft twines, embossed Kraft, printed Kraft burlap; fine Kraft mattings, printed, interwoven and leather bound; medium mattings of Kraft, Kraft toweling

Kraft Paper and its Uses.

BY W. R. BROWN.

THE many new and useful articles which are being manufactured out of paper, and more particularly out of Kraft paper, are of interest on account of their unusual character, and because they represent reduction in the cost of living and a close utilization of forest product, with its attendant beneficial effect on forestry. As is usual in matters of close utilization, foreign countries have been the pioneers in the use of wood fibre, and many of the products which are the subject of illustration are of Scandinavian manufacture. Their manufacture in this country will no doubt only be a matter of a short time, and open a wide field for profit.

The process of manufacturing sulphate pulp, from which Kraft paper is made, originated some twenty years ago in Sweden, and for some ten years was carried on in Sweden, Norway and Finland before being introduced into this country. The first mill for manufacturing sulphate pulp on this side of the Atlantic was established by the Brompton Pulp and Paper Company, at East Angus, Quebec, and they still continue one of the large producers, being exceeded only by the Wyagamac Pulp and Paper Company at Three Rivers, Quebec, and the Brown Corporation at La Tuque, Quebec.

Briefly, the process is what is known as the soda ash process to distinguish it from the sulphite process, the main points of difference being that the principal chemical used in the sulphate process is sodium sulphate, commonly called salt cake, which is mixed with chloride of lime to form caustic soda, and this, when reduced by heat, forms sodium sulphide carbonate, commonly known as black ash.

Sulphate pulp is sold to paper manufacturers throughout Canada and the United States, and there are thirty or more mills using this pulp which produce a little over a thousand tons of Kraft paper daily.

The distinguishing characteristic of Kraft is its extreme strength and resistance to wear by folding, due to the gentle action of the chemicals, which disintegrate the cellulose from the lignin and preserve the long fiber of the wood. It is of the brown color which is so often seen in wrappings for parcels or magazines. The tensile strength of this paper in comparison with other Manila wrappers of equal weight and thickness is from one-quarter to one-half greater. On account of the marked superiority of Kraft, many imitations have been put upon the market, but a return to the use of the original has almost always followed. While the price of Kraft is somewhat higher for wrappers per pound, the customer secures nearly half again additional area and a much stronger and more serviceable paper.

Large quantities of Kraft paper are used in the department stores, and by the large mail-order houses in the West who ship by parcel post. It is particularly suitable for envelopes, especially such as are manufactured for heavy documents and money, in place of leather-board containers. Strips of Kraft paper are used in binding the corners of cardboard boxes, particularly shoe boxes. Strips of gummed Kraft paper are used in the same manner as twine about boxes and packages, and are much stronger and do not slip off. Even coal is now being delivered in bags made of Kraft in place of canvas bags which had to be emptied and returned, the paper bags being merely burned up with the coal. With a light backing of cloth fibre and a filler against dampness, Kraft paper, called "Watershed," is used for covering automobile tires for shipment in place of burlap. "Watershed" paper is also used for the oversea shipment of dry goods and groceries. Kraft cardboard is used in the manufacture of dress suit cases. Embossed Kraft paper is used for wallpaper, book covers, and for covering fancy boxes. Very good imitation leather is made from Kraft. Stripped into narrow rolls one-eighth of an inch wide, it is run through a machine which gums one side. The gummed side is spread with a fine lint of cotton or linen. These strips are then run in a spinning machine and twisted into threads, from which the cotton and linen fibers protrude as a thin fuzz. This thread is afterwards woven into various fabrics, as imitation burlap for wallpaper, cloth for upholstering furniture, grain bags, tailors' linings for suits, imitation cotton and linen towels, webbing, straps for surcingles, bedding, etc. By the introduction of colored thread and stamping in colors, pleasing designs are worked into the fabrics. Small twine made of twisted Kraft paper is used for tying up bundles; is woven into coarse mattings, and furnishes the warp for cheap rugs and carpets. Twisted into many strands, it is woven into all sizes of rope, particularly laundry and window rope and binder twine for harvesting machines. To add strength, it is sometimes spun on a hemp core. One piece of rope of Kraft paper has a breaking strength of 28 pounds and runs 383 feet to the pound; another has a breaking strength of 24 pounds and runs 750 feet to the pound; a third has a hemp center, a breaking strength of 43 pounds and runs 642 feet to the pound. Kraft paper is also now being used as insulation in the wrapping of overhead and underground copper cables.

By a new patented process, the Berlin Mills Company is now producing paper pipe wound over cores of various diameters and made in various thicknesses, which is thoroughly permeated with a tar compound, forming a strong, compact pipe capable of taking a thread and lighter and less expensive and more durable than iron pipe. This is used for various purposes, such as underground conduits for electric wires and for resisting the action of various corrosive acids, especially in coal mines.

Kraft paper could be easily adapted to the same use discovered by a Japanese during the Russian war, who invented a soft, tough and waterproof paper which was used as a pellicular peignoir. They also made it into paper sheets which could be folded into a small package and which would keep out dampness. There are other uses for this paper, such as for napkins, handkerchiefs, paper plates, cups, pails and other articles too numerous to mention, but the most surprising use it has been put to is that one-eighth inch strips, shellaced and twisted, are used in manufacturing articles of furniture in the place of or in conjunction with rattan, such as chairs, tables and baby carriages. So it would appear that there was a profit in changing wood into pulp, making the pulp into paper, and turning the paper back again into wood.

Forest Pathology.

By Edward R. Linn.

INTRODUCTION.

THE tendencies of the lumber industries towards closer utilization has caused them to investigate more closely why certain things are, and whether or not they can be eliminated. Lumbering operations are carried on today, utilizing trees and parts of trees, which in the past would have been left in the woods. Timber is scarcer and any knowledge which can shed light on the problem of still further eliminating waste is of value to lumbermen.

DEFINITION.

Forest Pathology means diseases of trees. The diseases of trees mentioned in this paper are caused by fungi. Fungi are responsible for rot in trees. The true fungi together with the slime-fungi and bacteria constitute a group of plants of a low order, characterized by lack of chlorophyll (green coloring matter). In consequence the members of the group are unable to use light as a source of energy, and must obtain their foods as organized material, complex in comparison with the simple substances required by green plants. These fungi in short, are, in common with animals, ultimately dependent for the greater portion of their support on living or dead chlorophyllous plants.

Parasitic fungi are those which draw their nutriment from other living plants.

Saorophytic fungi are those which draw their nutriment from dead plants.

LIFE HISTORY OF A REPRESENTATIVE SPECIES.

Broadly speaking the life histories of the fungi taken up in this paper are the same. So a description of the fungus, trametes pini, which causes heart or brown rot of conifers will serve as an illustration for the whole group.

This is a dangerous forest parasite and occurs thruout Europe and America. It is found on most species of pine, also on spruce, hemlock, fir and tamarack. The sapwood of the pine is not attacked but on the others both sapwood and heartwood are affected.

The external appearance of the disease is evidenced by the dripping of resin from wounds and old branch stubs. The sporophores (fruiting bodies) on pine, spruce and fir, appear mostly at points where branches are broken off, forming clusters. On the fir, they may appear anywhere on the trunk. The resin contents being higher on the spruce, may account for sporophores being found more commonly on the stubs of old branches. In appearance the sporophores are hard, woody, brown or black, and deeply ridged. They are often hoof-shaped but vary greatly. The upper surface is rough and deeply ridged and continues to form annual zones for a number of years. The under or fruiting surface is made up of tubes or pores which are lined with basidia (microscopic projections) which bear four elliptical spores on stalks. The spores (which correspond to seeds in the higher plants) are carried by the wind, birds or insects to the broken branches or other wounds. With proper conditions of moisture they germinate, sending out slender filaments called mycelium. The mycelium spreads through branch and stem, particularly upward and downward in the same year ring. In this way longitudinal and peripheral zones are formed in the wood, giving rise to the popular name "ring scale."

Single hyphae (hair like filaments) bore through the cell walls, and a ferment secreted by them dissolves the incrusting substance (lignin), so that walls affected show the chemical reaction for cellulose almost at once.

A very characteristic feature is the appearance of isolated white spots or holes indicating where the wood, after becoming cellulose, has been dissolved out entirely. The fungus as it advances from heart wood to sap wood drives the resin before it, so that there is a dark region just in front of the fungus area.

In spruce and fir, the fungus can advance to the bark, but in pine, progress is checked at the sap wood by excess of rosin. After a tree is once dead the destruction seems to stop, in so far as the wood is concerned, but the sporophores form and function for three or four years. It is this faculty of fruiting on dead trees that must enable this fungus to spread through a forest in a very short time and accounts for the fact that it does. After a spruce has reached a certain age the chances that it will become affected with this parasite are, in the North woods, the very greatest. Older spruces which have reached a diameter of 10 to 12 inches are more often subject to attack than younger ones.

Remedial measures are the removal of all diseased trees when cutting and the prevention of unnecessary injuries to living branches or stems. The species trametes pini probably does four-fifths of the damage done by timber destroying fungi.

POLYPORUS SCHWEINITZII.

This fungus is common on white and red spruce, fir and pine. It is very destructive, attacking both young and old trees, entering through the root systems and growing up through the trunk for sometimes 40 to 50 feet from the ground. The diseased wood is yellow and has a cheesy consistency. When dried it powders easily.

The Sporophores appear either on the roots of the trees or at the base. They are soft, brilliant collored toadstools with a yellow to a red brown top. The fungus is found more frequently in places where the air is laden with moisture, as on lake shores. Nothing is known, as yet, of the exact manner in which the fungus enters the tree, nor the rate at which it grows within a tree, after having gained a foothold.

Because of its destructiveness polyporus schweinitzii is perhaps the most to be feared where living trees are concerned. In Europe a trench is dug around an infected tree or group of trees. Such a method cannot be recommended for American forest tree conditions, at least not for the present. There is no evidence that the fungus can infect the tree above the ground, consequently it need not be feared in burned over regions, or such as have been attacked by bark beetles.

POLYPORUS PINICOLA.

This fungus is one of the most frequent found on living, or more often dead, spruce, pine, fir, hemlock, and occasionally on birch and other deciduous trees. It is essentially a wound parasite, entering through the trunks and branches above ground. Old knot holes or branch wounds, wounds produced by animals or fire, are favorable spots for the entrance of the spores.

In regions where the bark beetles have been active, there are many trees the wood of which has been destroyed by this polyporus. Windfalls are attacked. The lumber could have been saved if picked up soon after the blowdown.

Spruce in which this fungus has been growing for some time, deserves the description "entirely rotted." The wood is changed into a brittle red brown mass, which has cracked in many directions. The individual pieces are barely held together by countless sheets of mycelium, which have filled the spaces resulting from the cracking of the wood. The sporophores of this fungus are large and conspicuous and are formed during spring and summer. They are sometimes hoof-shaped, but more often extended in the form of a bracket and lobed. Oftentimes the upper surface is almost black and shines as if varnished. The margin is bright red and rounded.

POLYPORUS SULPHUREUS.

This fungus has been found on white spruce but occurs more frequently on hardwoods. The maples and alders are common hosts in this vicinity.

The sporophores are flat and soft, the upper side being bright orange-red and the lower side sulphur-yellow. They last only for one year, hence are small; they frequently occur in masses, one above the other in tiers. The whole fungus is soft and fleshy. When mature it becomes hard and brittle. The fruiting bodies very rarely remain on the tree for any length of time as they are attacked by a number of insects. The fungus is sought by mushroom hunters on account of its excellent edible qualities. The fruiting bodies occur in July and August.

The disease enters the tree through wounds and broken branches. The mycelium spreads through the trunk of a tree, going up and down and reaches the highest branches and the roots.

The diseased wood is red-brown in color and can readily be distinguished from wood changed by other fungi by the fact that it breaks into slabs or flat pieces which correspond each to an annual ring of the wood. The brown rotted wood is hard, very brittle, and breaks into more or less rectangular pieces. When in its final stages it is extremely brittle and can be crushed to a powder.

DISEASES OF HARDWOODS.

The principal diseases of deciduous or hardwood forest trees are caused by a group of fungi which grow in the heartwood of the trees. The fungi which are responsible for the decay and destruction of the heart wood of various broad leaved trees are quite numerous. They are more or less alike, however, as to their manner of entrance into the trees, their subsequent development, the production of their fruiting bodies and the manner of their prevention.

FOMES IGNIARIUS.

The disease of deciduous trees caused by the "false tinder fungus" (Fomes igniarius) may be called the "white heart rot."

It is found in the four corners of the globe and in this vicinity occurs on beech, birch, maples, poplars, and the butternut or white walnut. In New England, beech is very susceptible, as high as 90 to 95 per cent being infected. It is almost impossible to find healthy stands of Aspen which have attained any age because of the extreme destruction wrought by the "false tinder fungus."

The sporophores are brown or gray in color, hoof-shaped; the upper side is concentrically marked and has a stone hard coating which is generally more or less cracked. The sporophores are very woody and of a rusty brown color inside. They have been found with as many as fifty layers, the average number being fifteen to thirty, indicating an age of the same number of years.

It is impossible to tell whether a tree is infected or not, until the fruiting bodies appear on the tree. The disease may infect the tree at any time. Diseased trees may sometimes be detected by pounding the tree with an axe and judging the sound.

It may be stated that the amount of damage caused by the white heart rot is very great, and its widespread distribution, together with the almost universal susceptibility of deciduous trees thereto, makes it the worst enemy of those species, especially during the period when they are approaching maturity.

When cut in two the trunk of a tree infected with the white rot, shows that the center has been transformed into a pulpy mass. having an irregular outline. This mass is definitely limited on the outside by one or more black layers. One of the most characteristic features of the decay of the trunk is that the decayed wood is confined to one large central mass. When the decayed wood is rubbed between the fingers it does not powder but breaks into fine flakes.

The only practicable manner of combatting this disease is to remove the trees.

SAP ROTS.

Besides the fungi previously described there are two forms which are usually considered parasitic on deciduous forest trees. These are Fomes fomentarius and Polyporus betulinus. Both are very common all over the Northern hemisphere. The manner in which they attack trees, however, is different from that described for the fungi which cause distinct heart rots of living trees. It has not yet been determined whether these fungi belong to the parasite group or whether they function as saprophytes.

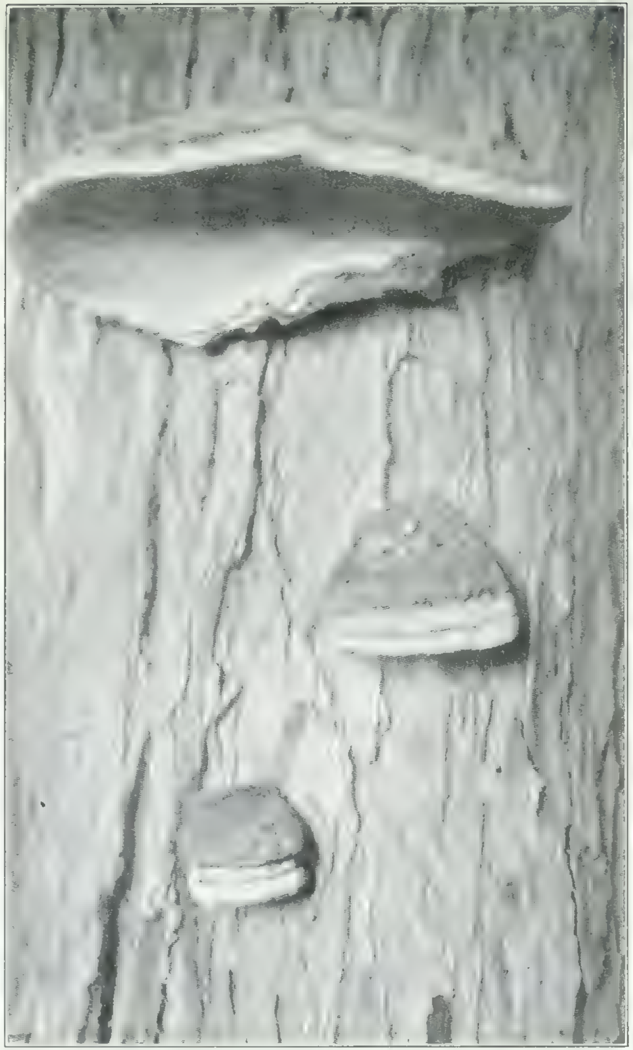
These two fungi rarely, if ever, cause heart rot. They are found on dead trees, logs and living trees. It is still a question whether the living trees were weakened by the fungi or whether the fungi were able to grow on the trees because of weakness from other causes.

FOMES FOMENTARIUS.

Fomes fomentarius occurs mainly on the beech and yellow birch. The sporophores are distinctly hoof-shaped. They appear as small rounded knobs on the surface of the trunk; that is, they are not confined to branch stubs but occur at other wounds. Their upper surface is smooth and marked with concentric rings. The older sporophores are uniformly gray and have a somewhat powdered appearance. The under surface is red-brown and shows numerous regular small round pores. For some distance above and below the seat of the sporophore, a furrow runs on the tree trunk, marking a tract where the mycelium has penetrated to the sap and killed it, so that growth in thickness ceases.

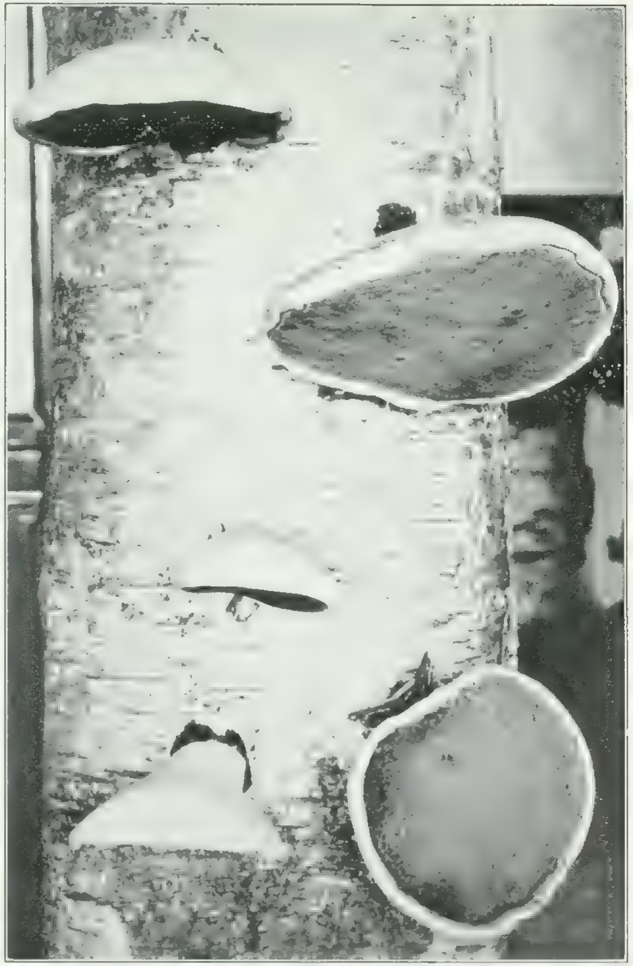
The decay induced by the fungus starts in the outer sap wood, immediately under the bark, and proceeds inwardly till it reaches the center of the tree. The decayed wood is bounded by numerous irregular black lines, bounding areas of wood not yet completely decayed. Wholly rotted wood is very soft and spongy, light yellowish in color and crumbles between the fingers into numerous separate wood fibres.

In New England the tinder fungus, Fomes fomentarius, is one of the commonest wood destroying forms found in hardwood forests.



TWO SPECIES OF FOMES

These are found on a large number of deciduous trees and a few evergreens. Members of this group attack beech, maple, yellow birch, sycamore, ash and black locust.



A WELL-KNOWN SPECIES

POLYPORUS BETULINUS

POLYPORUS BETULINUS.

So far as is known polyporus betulinus occurs only on species of birch. It is widely distributed over Europe, Asia and North America. In this country it occurs in the yellow, white and paper birch.

The sporophores form half rounded conspicuous brackets which start as small rounded knobs usually growing through a lenticel. These knobs rapidly expand till they form a hemi-spherical papery sporophore. The upper surface is very smooth, usually dirty white in color with no signs of marks or cracks. The outer margin is round and extends down over the lower surface, forming a decided ridge around it. The lower surface is brown and the pores are irregularly jagged. The sporophores are annual and grow in some instances to be quite large. The decay is very similar to that described for Fomes fomentarius. The decayed wood is very uniformly yellow in color and shows numerous cracks extending both radially and tangentially throughout the mass. Badly decayed wood crumbles into fine powder, and differs from birch wood destroyed by Fomes fomentarius in this respect. Wherever birch trees are weakened either by the fire or other causes, the birch fungus will attack with great rapidity, and it must be considered as one of the most destructive fungi to birch wood.

FUNGI AFFECTING THE MANUFACTURED PRODUCTS OF THE FOREST.

The line between those fungi which are capable of growing on dead wood that has died after being cut from a living tree and the fungi which grow on dead wood of the still living tree cannot be sharpely drawn.

The fungi described up to this point have been those that function on trees standing, either living, dead or partly dead. As we are interested in logs, timbers, pulpwood, ties, poles, etc., after they are cut, it would not be amiss to describe some of the rots that affect them. Both hardwood and softwood in the form of logs, dimension stuff, pulpwood, etc., are attacked by many wood destroying fungi. A good sample, on hard wood, is Polystictus versicolor, and, on soft wood is Lenzites sepiaria.

POLYSTICTUS VERSICOLOR.

This is probably the most widely distributed and in many respects, the most destructive fungus for hardwood. It is very cosmopolitan in its tastes and has no particular preference for any kind of wood, but grows with equal readiness on all hardwoods. It is the fungus which probably destroys 75 per cent or more of the broadleafed species used for ties. Wherever hardwood is used for posts it is to be found.

The sporophores are variable, depending on the kind of wood on which they grow and upon which they develop. They are small brackets, usually in clusters, very thin; the top is soft and hairy with bands of various colors, usually white and yellow. The under surface is generally snow white and the pores are exceedingly regular and minute.

Polystictus versicolor, as a rule, starts its development in some season crack. The spores germinate where a sufficient amount of water and air is available, and the rapidly growing hyphae spread through the wood, starting with the medullary rays. The fungus first of all attacks the sugars and starches stored in the sapwood and then attacks the woody fibre itself. The minute changes which take place in the wood fibre consist of a rapid solution of various parts of the woody structure in its entirety. In other words, the fungus has no special preference for either lignin or cellulose parts of the cell wall. The wood has become what is popularly known as "punky." It has lost all its usual characteristics of hardness and strength and has turned into a soft dry, non-resistant, pithy mass, which is usually more or less straw colored.

LENZITES SEPIARIA.

This fungus is found wherever soft wood timbers are used. The sporophores are rather small for a wood rotting fungus. They rarely project more than two inches from the substratum, and are commonly long, narrow, shelf-like formations, extending horizontally from the surface of the wood. They are frequently compound or are clustered closely together, and are especially numerous on the side of affected timbers. The color varies according to age. The youngest are white which shades off into a yellow and brown and in very old specimens they may be black. Sporophores of Lenzites sepiaria may remain dry and apparently lifeless for a long period and still be able to produce viable spores under favorable conditions. The number of spores produced by an ordinary sized sporophore is literally millions.

Buller (1909) has shown that a sporophore of Dedalea confragosa (Bolt) Pers., about two square inches in area, produces nearly three-quarters of a million spores, when revived after dessication. This is much like Lenzites sepiaria in the character of the sporophores and may be taken as indicative of the conditions occurring with the latter species.

It is easy to see, then, that where there are sporophores, no timber can be expected to remain free from them any length of time.

About $8,000,000 worth of ties and poles annually have their lives seriously shortened by this fungus. Moreover there are vast quantities of timber in the form of piling, bridge timbers, trestles, sidewalks, fence posts, etc., which are also destroyed by this fungus.

FACTORS GOVERNING DECAY.

The factors governing decay are:

Food Supply,
Air Supply,
Water Supply,
Temperature.

(Food supply). As the cells and cell contents of the wood are the food supply, we cannot eliminate those factors without using a substitute for wood itself.

(Air supply). Wood rotting fungi are living organisms and need a certain amount of oxygen. Cutting off the air stops decay. This fact explains why wood remains sound for hundreds of years when buried, or when lying on the bottom of streams and lakes. The rafting or driving of timber is said to have a marked effect in preventing decay, and this effect may probably be explained in the same way, although it is likely that the food substances in the cell cavities are dissolved and partly removed by the solvent action of the water.

(Water supply.) A certain degree of moisture is necessary for the growth of wood rotting fungi. Well seasoned wood loses much of its susceptibility to attack by fungi and as long as it remains relatively free from water it will not rot. Wood from the royal tombs of Egypt is perfectly sound after a period of over 5000 years.

(Temperature.) These fungi grow at ordinary temperatures but make little or no growth at freezing point or below.

TIME OF CUTTING.

Contrary to a somewhat popular opinion, wood cut in winter contains as much, if not more, sap than if cut in summer. Since decay is not sap fermentation and is really independent of the natural sap, the amount and kind of sap in the wood at the time of cutting can have no direct bearing upon the problem. Winter felled timber is cut at a time when decay is arrested and the liability of infection reduced. If cut in summer infection is almost certain to follow immediately and loss from rot will result unless the material is sawed up promptly and dried quickly. The presence of season checks increases the liability of infection. Wood seasons more rapidly in summer than in winter; hence, winter cut material will remain immune longer than summer cut.

It is not the time of cutting that counts but the subsequent treatment that the wood receives.

CONCLUSION.

To date, the popular belief concerning the so called boundless forests in America coupled with the economic conditions of manufacturing and marketing, has prevented the lumberman from paying any but the most superficial attention to the question of combatting decay.

In the manufactured articles, though, even today we are beginning to see a change, for example; the treating of ties, posts and poles with various antiseptic substances; the dipping of yellow pine boards, in the south, to prevent blueing; the careful seasoning, painting or oiling of structural timbers used in permanent structures.

How soon will we begin to devise methods of harvesting wood products to eliminate the decay in standing living trees?

In our locality we have seen that all trees are subject to rot. Old trees do not rot because they are old, but because they have more wounds and are exposed to infection longer.

A mature stand of trees does not increase in board foot contents, because of rot, windfalls and insects. Oftentimes the annual increment is not sufficient to offset the destruction caused by outside agencies and we have a loss instead of a gain.

Except in rare cases, it is neither feasible nor profitable to allow stands of "popple" to reach maturity, in this vicinity. The older the stand, the less sound wood there is.

Hardwoods need more study before we can cruise, buy or sell stumpage, or manufacture intelligently, and a good bit of the reason we can lay to rot.

Mature areas should be cut; especially those which have the optimum conditions favorable to decay.

In Canada, in the districts where the pulpwood is owned in scattered lots, windfalls and slightly burned wood can be picked up, and made into rough wood. This is being done in some places.

In closing let me point out that we cannot take out of the woods, every tree that has decay in it and remove every fungus, but we can cut mature stands, we can pick up the blowdowns, we can harvest slightly burned wood, we can learn more about the nature of our different woods and their susceptibilities to fungus diseases.

There are 196,000,000 acres in the U. S. National Forests. It is estimated that 2% to 10% of the mature trees are rendered absolutely useless by wood rotting fungi.

How much more is partially useless?

A few years ago insect attacks were considered impossible to combat.

It will not be long before we are using strict sanitary measures to protect our forests from fungus diseases.

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Illustrations for this paper obtained through the courtesy of the American Forestry Magazine.

Hardwood.

BY JAMES W. KEENAN.

ESTIMATING STANDING TIMBER.

ON deciding to start a hardwood operation the first thing to do is to determine the merchantably valuable trees when standing.

The most desirable trees are those from which two logs can be taken. The first or butt log to be sixteen feet long and the second log ten, twelve or fourteen feet long, twelve inches and up in diameter at the small end. Quite often only one log can be gotten out of each tree, on account of crooks, limbs well down on the sides, or various other defects. To determine just what there is, it is necessary to make a pretty thorough examination of the territory, for hardwood, when standing, is very deceptive and different from a softwood growth.

When travelling through a woods of spruce, fir and pine growth one naturally considers that a majority of the trees that are large enough for commercial use are merchantable. This rule, however, cannot be applied to a hardwood growth, for on closer examination it is found that a great many of the largest trees are over-matured, and have commenced to decay. Some are hollow, which fact can be determined by striking a few blows on them with an axe; others have large winding seams; some have decayed places or holes upon their sides; still others have a large limb or part of the top broken off, where the water has entered and caused decay or rot in streaks as it worked down through the tree. Occasionally, by cutting these trees in several places, a part, or possibly one twelve or fourteen foot log that is sound and merchantable is found. Medium-sized yellow birches are the most desirable. Large maples, as a rule, are very faulty, as they are inclined to be black hearted and shaky, and usually saw out poor. Straight, clean rock maple, when found to be the right age, is considered good lumber. Beech is usually crooked and is classed as low-grade and a poor seller, when manufactured. Birch is the most desirable, and if there is sixty per cent or upwards, a ready market and better prices are more easily found. Ash and basswood, when clear, are classed with birch.

In hurrieldy looking over and estimating hardwood we arrive at a decision as to the amount found. Then, considering the quality of lumber that the market of today calls for, we should divide the amount of that decision by two, for the reason that a great many trees that look good at a distance, and very often looks good on closer examination, prove faulty and worthless when cut down.

In the manufacture of bobbins or small squares one could figure somewhat differently. For boards and plank, straight, clean logs, not less than ten inches in diameter at the small end, and lengths ten to sixteen feet, are required. In the manufacture of bobbins, squares or novelties, logs can be taken as small as six inches in diameter and eight feet in length.

The bobbin business has been very unsteady in the past. It is not expensive to prepare for their manufacture, and when the market is good for these products, many small operators arrange for their manufacture. As the market is limited it is very soon overstocked, and there have been more small bobbin concerns compelled to suspend business within the past fifteen years, than there has in any other branch of the lumber business.

It is just as expensive to log an inferior class of hardwood as it is to log a good class; therefore, in our estimate, only that class which will bring the best price when put on the market, should be considered.

ACCESSIBILITY.

One very important item to be considered is the accessibility of the timber to a railroad or shipping point, where a mill can be erected. If hardwood is so located that it can be cut down and yarded in the fall and early winter, and later hauled directly to the mill, it is more valuable than if it has to be hauled, then loaded on cars and shipped any distance. Hardwood standing on steep, rough ground is not considered very valuable. It is usually of poor quality and expensive to get.

LOGGING.

The most economical way to log hardwood would be to cut into the lengths required, in the woods, then yard it into good, large piles at a point on a main road where it can be loaded onto two-sleds and hauled to the mill. It is not profitable to haul hardwood logs a very great distance on one sled, and when yarding, it should be so arranged that the hauls would be short. It is important that there should be a large per cent of the logs fourteen and sixteen feet long. In order to successfully market the lumber we must have at least forty per cent of the boards fourteen and sixteen feet long; and to insure this, sixty per cent of the logs must be of these lengths, as a good many short boards are taken from the sides of long logs.

MILL.

The erection of a temporary mill for the manufacture of hardwood is not necessarily very expensive. The building required should be about sixty feet in length, and twenty to twenty-five feet in width. A rough substantial frame closed in with rough, cheap lumber, having installed therein a boiler, engine, board machine, edger and trimmer, slab saw, to be used for cutting up the slabs and edgings, and sawdust blower or conveyor. To successfully manufacture hardwood it is important to have plenty of power. The ordinary portable mill is not sufficient. The boiler should be eighty to ninety horsepower, and the engine not less than seventy-five horse power. The boiler should be set on a rough stone foundation, and the engine can be set on a substantial log foundation, that is well bedded into the ground.

A rough figure as to the cost of such a mill is as follows:

Building	$ 600 00
Shafting and pulleys	400 00
Boiler	700 00
Engine	450 00
Board machine with rope feed and two saws	700 00
Roll feed edger	175 00
Trimmer	175 00
Slab saw and frame	50 00
Sawdust blower and pipe	100 00
Belts for all	300 00
Making a total for new mill of	$3650 00

MANUFACTURE.

Logs should be sawn so as to produce the greatest amount of valuable lumber. When the log is put on the carriage and a slab taken off, boards should be sawn until the white part or the sap, as it is called, is all taken off. Then the log should be turned on the carriage until the sap is sawn from each side. Saw around the log again, taking off the red, which is the most valuable part, until the heart piece is about five inches square. This heart piece is considered the poorest part of the log, and should be sawed in 1½ and 1¾ inch thicknesses, for railroad shims, or if sawed into boards must go into the cheapest grade.

GRADING.

If the lumber is manufactured before being sold it is very important to be familar with the requirements of the purchaser, as the lumber must then be sold on grade, which means Firsts and Seconds, No. 1 Common, No. 2 Common, and No. 3 Common.

This grading should be done as the lumber comes from the mill, and each grade put in separate piles in the yard. But grading green lumber cannot be relied upon. Many boards change in appearance when dried. Some show defects that are not noticeable when green, others season check, while others check split at the ends, necessitating the cutting of a piece from the end of the board, or putting it into a lower and cheaper grade. The final grading must be done when the lumber is shipped.

Firsts and Seconds are the best grades and usually sell together for the best prices. Lumber in these grades must be six inches wide and over, and eight to sixteen feet long, and must not exceed ten per cent of eight and ten foot lengths. In these grades boards four to nine feet surface measure must be clear; ten to fifteen feet surface measure may have one knot or standard defect, sixteen feet and over surface measure may have two standard defects or their equivalent.

No. 1 Common ranks next after Firsts and Seconds, and sells for from six to eight dollars less per thousand feet. This grade will admit boards four inches wide and four feet in length, but not over thirty per cent shorter than ten feet will be admitted in this grade. Boards four to seven feet long must be clear.

No. 2 Common will admit a larger per cent of short lumber. Boards three inches wide, four and six feet long must be clear, other lengths and widths must work fifty per cent clear in not over three cuttings. The price for this grade ranks from four to six dollars less per thousand feet than No. 1 Common.

No. 3 Common must be three inches wide and over, and four feet long and over. It must contain at least 25 per cent sound cutting. A manufacturer, unfamiliar with the sale of hardwood, is usually left with this grade on his hands; which if sold at all, must be sold at a very low price.

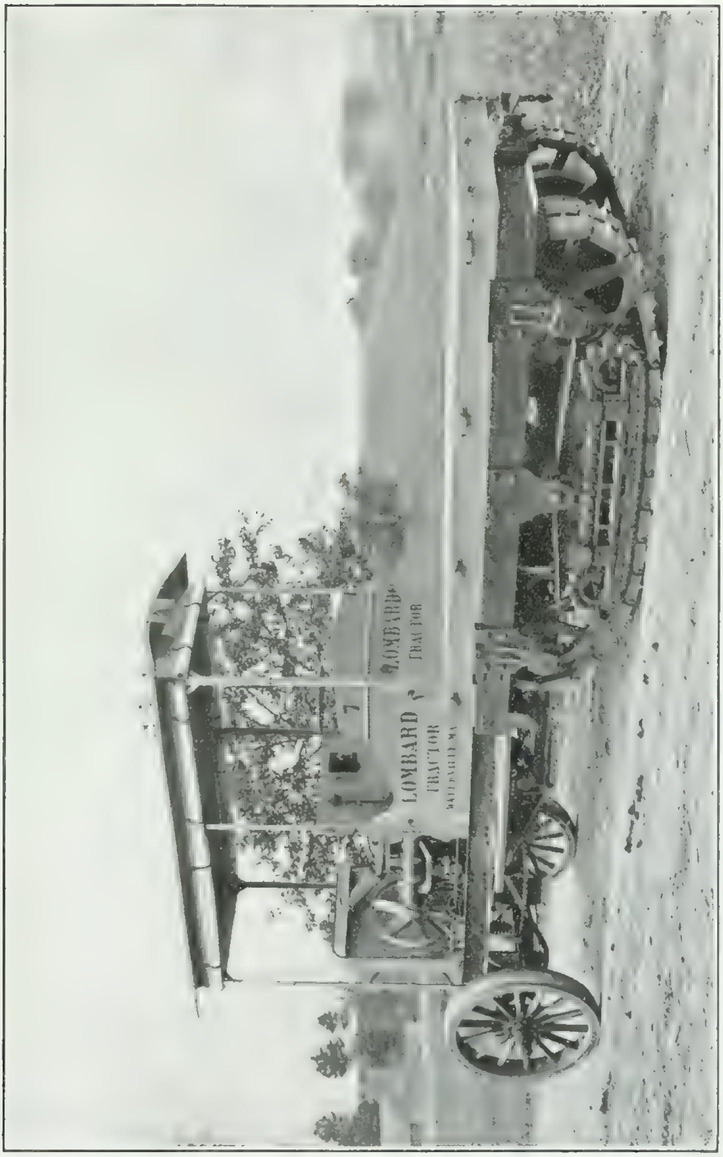
In sawing hardwood for one inch boards it is necessary to saw it one and one-sixteenth inches thick, so it will be a plump inch when dry. All the boards should be parallel and square-edged, well trimmed, of even thickness and even lengths in feet. A purchaser makes no allowance for the fraction of a foot, and objects to paying freight on odd lengths that are of no value when delivered. When a good class of logs are selected, properly manufactured and graded, they usually produce about 35% Firsts and Seconds, 25% No. 1 Common, 25% No. 2 Common, and 15% No. 3 Common.

The hardwood business is young in this section and the western buyers coming in are up to all tricks in the game. When they buy on grade and send along their inspector to do the shipping, and the manufacturer not being familiar with the business, naturally they will grade the lumber pretty close. In many cases they get some of the better grades at low-grade prices, and leave the lowest grade behind. Consequently, a loss to the manufacturer.

In other cases they will come and look the logs over before they are manufactured, and buy the lumber log-run. This leaves the low grade, or No. 3 Common out. Another loss to the manufacturer.

In some cases the greatest loss in this business occurs right in the woods, by not properly culling the logs. Again it occurs at the mill by improper sawing.

In other cases hardwood has been sawed on the same principle as soft wood; that is, after the log has been squared up on the carriage it is then sawed through and through into boards, leaving a portion of the heart in the middle of each board. Lumber manufactured in this manner, usually sells at a moderate price for chair stock or other kinds of small furniture.


LOMBARD
TRACTOR
LOMBARD
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7

WASTE.

Unless the lumber is manufactured close to a large town, where there is a good market for firewood, the waste does not much more than pay the cost of handling.

CONCLUSION.

The most successful way to conduct a hardwood operation is:

1st. Let the logging contract.

2nd. Carefully select the logs in the woods.

3rd. Let the sawing contract, this to include putting the lumber on sticks.

4th. Get in touch with a reliable purchaser.

5th. Sell the lumber, mill run; this means No. 3 Common and better.

Have it manufactured and graded to the purchaser's order, measured when coming from the mill, accepted and paid for monthly, after it has been put on sticks, in the yard.

Then, when the sawing is completed and all the lumber on sticks, the job is cleaned up and the purchaser can distribute the lumber thereafter within a reasonable time as he desires.

Mechanical Log Haulers and Their Development.

By Simmons Brown.

HALF a century ago the cost of handling logs from the stump to the mill was comparatively small. Operators found their supply of standing timber within easy hauling distance of their mills or close to drivable streams, and often mules and horses were used for both yarding and two-sledding to mills or landings.

Twenty-five years later the easily accessible timber began to disappear necessitating long hauls and causing the timber operator to turn to the problem of introducing some mechanical means for hauling in place of animals. The difficulty was to find some traction device which would adapt itself to snow roads full of irregularities, steep pitches, and grades.

George T. Glover, a lumberman in Michigan, was the first man to build and operate a mechanical log hauler. His snow locomotive weighing twenty-five tons was placed on sleds in such a way that its weight could be shifted to bear down on the traction device. The traction surface was in the form of a revolving iron cylinder, provided with teeth which gripped the snow and ice surfaces, and was so hung on a hinged frame that it automatically rose and fell with the inequalities of the road. The traction cylinder was kept at a high temperature by means of the exhaust steam, thus melting the road and making a firm surface for the runners of the engine and sleds to follow. This machine, however, was not a success because it had insufficient traction surface on the cylinder to make it effective on loose snow.

Ira Q. A. Peavey, an expert machinist of Bangor invented a log hauler which had a frame of angle steel such as is used in bridge work. It was operated by an upright engine of six cylinders each 3½ inches supplied with steam from a forty-five horse power boiler. The engine revolved four cylinders which formed the traction surface. These cylinders were made of ¾" tubing steel, had a diameter of 10½ inches and carried a thread projecting 5-16 of an inch above the surface running in a spiral around the cylinder at a 16 inch pitch. The two front cylinders, ten feet in length, carried the main body of the machine, while the other two, eight feet long, and just behind the front pair were used for steering. Although this machine gave several promising demonstrations it never proved successful.

Experiments were made with many other devices but all like those mentioned were abandoned as not practical or efficient.

The first successful steam log hauler was built by Lombard Brothers of Waterville, Maine, about ten years ago. This machine has the general appearance of an ordinary locomotive except that in place of the driving wheels, a patented form of a traction device is substituted. The boiler is the regular locomotive type built to stand two hundred pounds of steam to the square inch, is 15 feet long and 36 inches in diameter, and is mounted on a heavy reinforced channel steel frame. The water tank is placed directly under the boiler and has a capacity of ten barrels which will run the hauler about five miles. One to one and a half tons of coal or six cords of wood is sufficient to feed the boiler for ten hours' work, a distance of from 25 to 30 miles. Power to drive the tractors is furnished by four vertical cylinders 6½" bore with an 8" stroke. Two cylinders are placed on each side bolted to boiler and frame.

The traction device consists of two heavy steel runners which supports the weight of the machine, being about 20 tons, hung on a 4½" shaft. At each end of the runners are attached a pair of heavy boxes in which a hammered iron shaft runs carrying heavy steel sprockets. Each set of sprockets mesh into and carry an endless tread, or lag chain. These chains are twelve inches wide and fourteen feet long. Calks run the entire width of the lags and thus form the traction surface. To overcome the friction between the steel runners and the lag chains, two nickel steel roller chains, one on each side of the sprocket, run in tool steel channels attached to the under side of the shoe or runner, and inside of the tread or lag chain. The bearing surface of this traction device is approximately four and a half feet. The necessary crew to handle this machine is three men, the engineer, fireman and pilot.

These steam log haulers are now used quite extensively particularly in the Lake regions. No less than 54 different companies in the middle west have used and operated from one to six machines. In the Province of Ontario seven different concerns have operated them.

Before taking up the latest development in log haulers, it would be well to consider some results obtained by the steam log haulers.

In 1907 the Berlin Mills Co. operated two of the Lombard machines. These machines were operated by two shifts day and night over a 7.5 mile road. In 65 days they hauled over 3,400,000 feet of logs averaging 6,225 feet to the sled and 18,000 feet to the turn, the largest train being 37,700 feet. The average time per turn was about two hours and thirty minutes. To handle this amount of logs in the same time would have required at least 62 horses.

The Beltramic Cedar & Land Co. using a log hauler made two trips a day over a ten mile road, hauling six sleds at a trip with loads half again as heavy as a four horse team could haul over the same road. Allowing $15.00 per day for wear and tear of machine, their operative cost of hauler was $35.00. They figured that twelve four horse teams to haul the same amount would cost $72.00. A saving of over 50% by using the log hauler.

For the past three years the Paris Manufacturing Co. has operated a steam log hauler. Last winter they hauled hardwood over a road seven miles long, making three trips per day, averaging 20,000 feet per turn. On a five per cent grade they were obliged to split their loads and double back so that their total daily mileage was 48 miles. Because of past trouble owing to sleds not tracking, they now use a keel shoe and stiff hardwood reaches instead of chains. The approximate cost per day was $30.00 allowing $13.00 for depreciation and repairs and $17.00 for train crew including engineer, fireman, conductor, steerer, blacksmith and watchman. They figure that on an average road the log hauler will cover twice the distance of a four horse team and haul ten times the load.

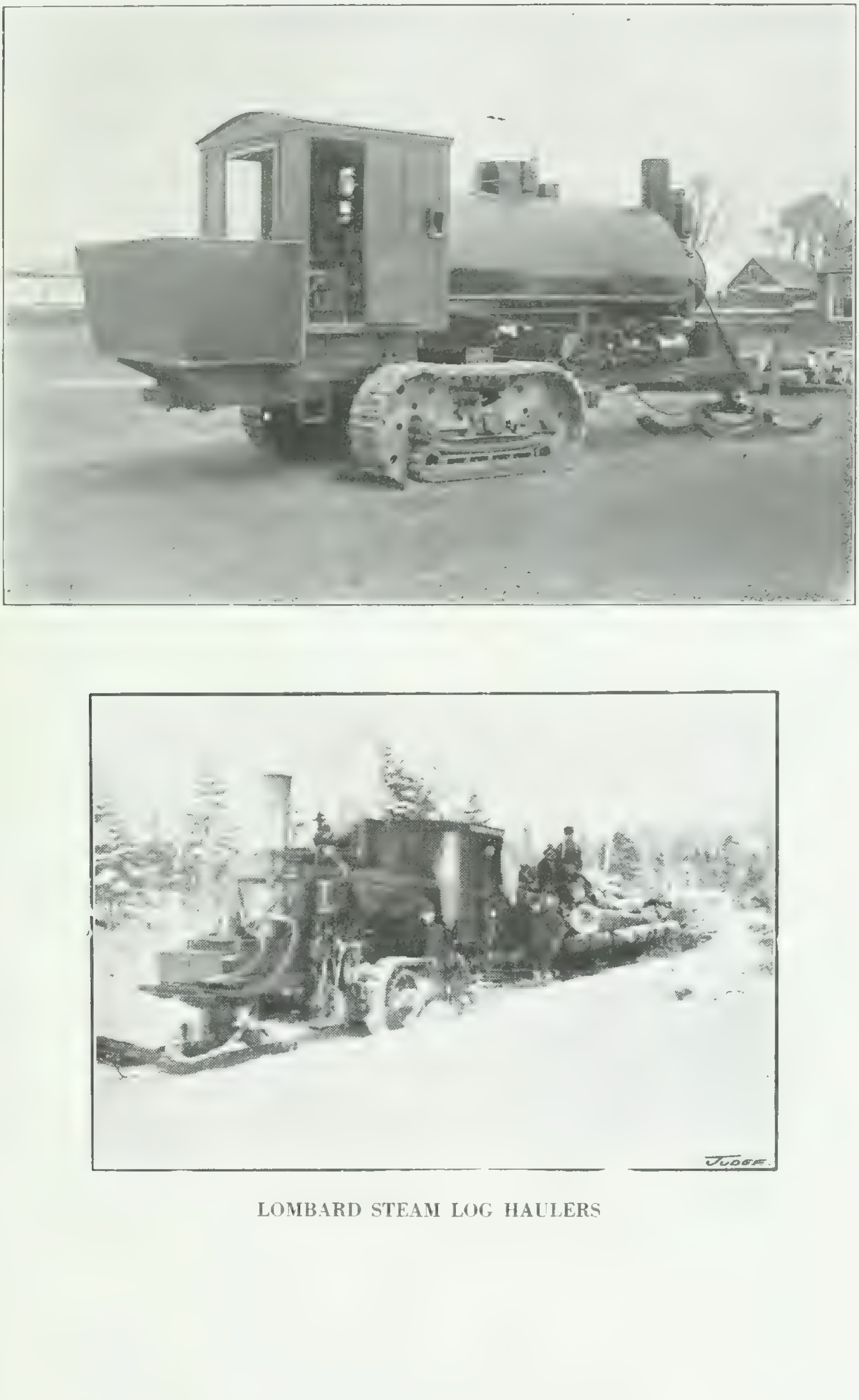
In the Adirondacks haulers have carried 15 cords of spruce pulpwood over roads having ten and eleven per cent grades. A single machine has hauled fourteen sleds averaging 6000 to 7000 feet making a train of about 90,000 feet. A record distance of 84 miles in 24 hours has been reported.

In the latest development of the log hauler gasolene has been substituted for steam.

Three years ago the Lombard Brothers commenced to manufacture a tractor having a four cylinder, four cycle engine 6" bore by 6½" stroke which develops sixty horse power. This machine has three speeds forward, two, four and six miles per hour and reverse, using sliding gears and multiple disc clutch. The weight of the machine is seven tons.

Last winter Donald Fraser & Son Ltd. operated ten of these machines in Quebec and New Brunswick. One of their machines made three turns per ten hour day over a seven mile road hauling out five sleds carrying 7,000 feet per trip. On some of the hill grades it would have been impossible for a team to have hauled one loaded sled. The machine broke out a branch road in loose snow where a team could scarcely have hauled an empty sled. Twenty-five horses would have been required to do the work of this machine.

This year the Lombard people have made further improvements in their gasolene tractor. Instead of four they now build their engines with six cylinders thus increasing the horse power from sixty to seventy-five. Where the last year's machine had sliding gears, the new machine has an independent friction clutch for each speed which facilitates the changing of speeds with minimum loss of momentum. With this system there can be no stripping of gears. There are but two speeds forward, high at a rate of six miles per hour and low at two and a half miles per hour. For the purpose of making it impossible to over-speed the engine on down grades the main driving shaft is connected with the engine by means of a ratchet coupling.



LOMBARD STEAM LOG HAULERS

To prevent an operator from over-speeding the engine by opening the throttle too wide, a governor is provided which limits the number of revolutions to 800 per minute. The new machine has a worm drive. Gasoline capacity is 60 gallons, sufficient for a day's work, and the machine weighs nine tons.

The writer watched a demonstration of this new tractor at Waterville some weeks ago. After running around the yard two or three times, it was hooked on to a sled loaded with five tons of pig iron. This load it hauled over the bare ground and up a grade of 7½ per cent. The test was repeated several times bringing the machine to a full stop half way up the grade, and starting again without any apparent difficulty.

Some of the advantages of the gasoline log hauler as compared with the steam machine are:—

The former weighs less than the latter and its weight is closer to the ground making it less top heavy. Where three men, engineer, fireman and pilot, are required to operate the steam machine, one man can easily handle the gasoline machine. The steam machine must take on water every five miles. The gasoline hauler takes on 60 gallons of gasoline in the morning and is good for all day, nor has it any boiler tubes to burn out when going up or down grades.

In general the mechanical log hauler increases its efficiency with the length of the haul and is generally considered to be superior to horses when the haul is over four miles. The log hauler being inanimate is not subject to fatigue, eats nothing when not in action and although mechanically sick at times, never contracts a fatal disease. It can be operated both day and night by working two shifts.

When a log hauler is used in place of horses the initial cost of making the road is about double because stronger bridges must be built and greater care must be taken in side skidding the curves to prevent sleds from leaving the road. Sharp curves must be avoided if possible because of difficulty in making the train of sleds track properly. Grades of over 5% should be eliminated and particularly steep pitches. If the pitches cannot be avoided they should be properly sanded because the majority of accidents to the log hauler occur on the down grades as the sleds are apt to forge ahead, jack-knife and turn out of the road.

Larger and stronger sleds must be used for log haulers because not only is there a heavier load per sled but there is a greater strain in starting and stopping. Hardwood poles should be substituted for reach and cross chains thus facilitating the tracking of the sleds. The gauge of the sleds should be four feet wide so that they will track on the surface made smooth by the lag chains of the tractor.

To operate a log hauler to its maximum efficiency there should be no time lost. To make this possible three sets of sleds must be used, one at the skidways, one on the road and one at the landing.

Sufficient skidways and rollways should be placed at five and one-half feet to six feet apart to avoid the uncoupling of sleds, each end of the road should form a loop enabling the hauler to place empty sleds, round the top of the loop, pick up loaded sleds, and always be headed in the right direction. The same applies at the landing.

Not the least essential feature in the operation of a log hauler is the handling and care of the machine itself. A first class man should operate it during the day and at night it should be run into a warm place where another first class machinist should give it a thorough going over to make sure that all parts are tightened, those parts needing it, well greased and oiled, ready for the next day's work. On an average haul of over four miles and with proper care the log hauler should save any operator who has 2,000,000 feet or more to take out, from 30 to 50% on his hauling.

It must be borne in mind no two operations will show the same results because of the physical variations of the country, the difference in the amount, kind and size of timber to be hauled, the amount expended in building the road, and the care exercised by those in charge of the operation.

The mechanical log hauler, as developed to its present efficiency, has undoubtedly come to stay.

Pulpwood Loading and Receiving.

By Peter McCrystle.

THE pulpwood scaled and received at the mills of our company in Berlin, N. H., consists principally of black and white spruce wood with a considerable percentage of fir balsam mixed in and from time to time an occasional car of peeled hemlock. It is either purchased in the open markets from jobbers large and small along the lines of the railroads in Canada or is shipped in by various subsidiary companies that operate individual tracts of land in Canada and New England as feeders to the main companies. These subsidiary companies haul the wood either directly to the railroads for loading and shipment at a siding or drive it down some river to a hauling out plant connecting with a railroad line to Berlin. The pulpwood comes usually in four foot lengths, piled evenly in box cars, peeled or with the bark left on, called rough wood, or in some instances from the Company's subsidiary plants cut into two foot lengths peeled and rough, and dumped over the top into rack cars. As the jobbers wish to secure a large scale, irresponsible ones resort to various methods of dishonest loading to deceive the mills and the scaling of this wood will always call for constant vigilance. But as a large per cent. of the wood which we now receive is handled under the direction of our own district managers, who also secure wood offered in their districts from independent makers, there is no reason why all of the wood which is shipped from these operations should not be loaded in a careful and workmanlike manner and I will attempt to give you the directions as to how this may be properly done.

LOADING REQUIREMENTS.

At loading points we find that shippers are furnished by the railroads with cars of various dimensions. This fact necessitates that thought be given to the number and manner in which the tiers shall be placed in the different sized cars in order to utilize all of the available space, which means a saving in the cost of loading as well as in the cost of unloading, for two cars containing an equal amount of wood to that contained in three cars could be both loaded and unloaded more cheaply than the three cars.

A good rule to follow in loading is as follows:

For cars 30 to 35 feet in length, three tiers in either end and one tier in the center.

For cars 36 to 40 feet in length, four tiers in one end and three tiers in the other end, and one center tier; unless car is over 8½ feet wide, in which case two tiers should be placed in the center.

Cars which are 8½ feet or less in width never should be loaded with more than one center tier, for the end of one of the tiers will butt into the doorway, and as it may be necessary to unload the car from that side of the mill, the door will be damaged in opening, causing delay to the unloading crew, as well as expense to the mill for repairs to the car.

Where but one center tier is loaded in the car, it should be placed in the middle of the space between the two doors in order to support the end tiers and to keep the wood out of the door casing. The loaders sometimes close the door on the opposite side to where they are loading, and, although they may not butt the center tier against this door, they pile it so close that it slides against it.

The center tiers should be piled as carefully as the end tiers, and under no circumstances should loose wood be thrown into the center after the tiers are piled, as it is liable to fall out en route, and also causes a great deal of trouble to the scalers and unloaders.

MIXING WOOD.

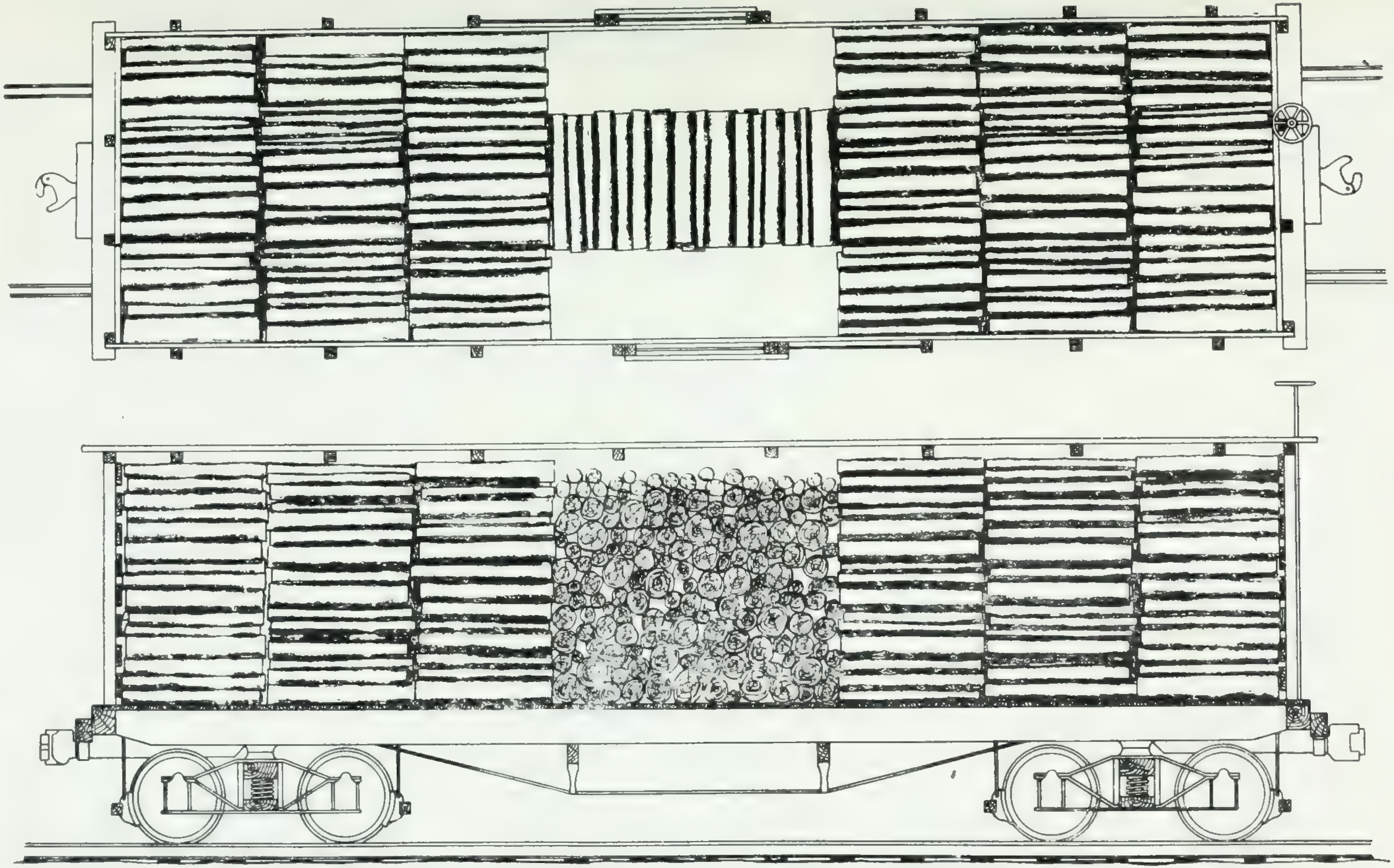
Another detail in regard to loading which causes a great deal of trouble and expense at the mill is where hemlock and woods foreign to the requirements of the Company's pulp and paper mills, such as poplar, pine and bass wood, are mixed in with the spruce and fir. This is especially so at the Burgess Mill where they manufacture a very high grade of bleached sulphite fibre, in the manufacture of which it is very important that only spruce and fir wood be used.

ORGANIZATION IN LOADING.

It has been our experience that the best loading is done under the supervision of men who have had some actual knowledge of mill requirements. One of the secrets of proper loading is to have a well organized crew under the direction of a foreman who understands just what is required in the proper loading of pulpwood.

IMPROPER LOADING.

In addition to cars which we receive that are improperly loaded through lack of knowledge or carelessness, we now and then find a car which has evidently been loaded with the intent and purpose to deceive the mill as to the true number of cords which it contains. For this purpose such devices are used as intentional loose piling; the ends of wood crossed; voids



PROPERLY LOADED 31 FOOT PULPWOOD CARS.

left in the tiers; the butts of the sticks placed to the front causing tiers to tilt back; and the including of poorly trimmed wood.

These points do not, however, apply to loading which is done under the supervision of our own men, except in some cases where the job of loading may be let at a certain price per cord, in which case the jobber may try to take advantage by means of some of these improper methods of loading.

SURVEYING.

METHOD OF SURVEYING -When pulpwood cars are received at the mill they first have to be surveyed as the cars are unloaded, and for this purpose a very complete system has been put into practice at the Company's mills in Berlin. In order to fill out the details of the records and scale forms used, it is absolutely necessary for the scaler to make such a careful and accurate scale of every car that the Company can be positive that both they and the shipper are receiving a just measurement.

In taking measurements a six foot hardwood rule is used, two sides of which are divided into feet and tenths of feet to facilitate figuring. The other two sides are divided into feet and inches for use in measuring the length of sticks so as to ascertain the average length of the wood.

The method of measuring is as follows:

First—Every tier in the car must be measured separately, and the scaler is not allowed to measure a tier until the space is clear so that the rule can be placed against the wood. In order to do this, measurements are taken of all the wood which is piled in the center of the car and the first end tiers, after which this wood is thrown out before any measurements are made.

Second—The next end tiers are then measured and the width of the car carefully taken. After these tiers are thrown out the remaining tiers in each end are measured one by one in the same manner.

Third—All of these measurements are recorded in detail, and the Company has on file complete records of every car which has been received since they began business.

In addition to recording the measurements of the wood, the scaler has to make records under the following headings:—

STYLE. Under this heading is given length of wood in inches and whether it is peeled, rossed or rough.

CONDITION. Whether the wood is green, dry or wet. The wet wood being that which is taken directly from the river and shipped.

MARKS. Any distinguishing marks whether stamped or otherwise are included under this heading.

PER CENT OF SPRUCE AND FIR. Here is recorded the estimated amount of each kind of these woods contained in the car.

AVERAGE DIAMETER. The average diameter of the wood in each survey is taken for recording under this heading.

LENGTH 30 PIECES. 30 pieces of wood are measured in the second and third survey and the number of inches these pieces are over or under 48 are added or subtracted and the total divided by 30 to obtain the average length of the wood in the car.

PIECES OF ROTTEN WOOD. The number of rotten sticks in each scale are recorded, and by the use of the following tables the scaler makes an equivalent deduction in cords for the total amount of rotten wood which he finds in the car.

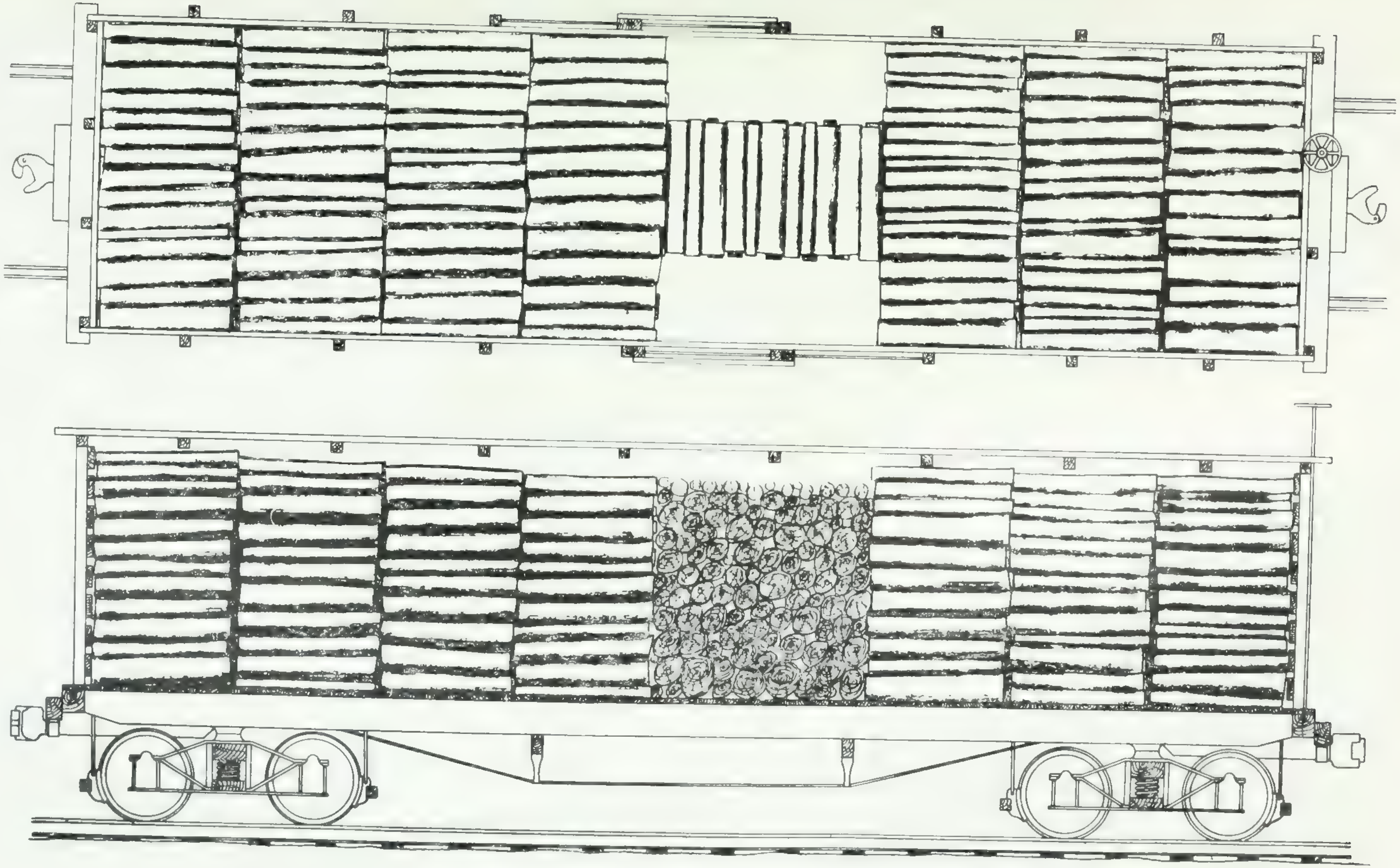
NUMBER OF PIECES REQUIRED PER CORD OF ROUND WOOD.

Diam. "	Pieces Per Cord	Diam. "	Pieces
4	288	14	24
5	180	15	21
6	128	16	18
7	94	17	16
8	72	18	14
9	57	19	13
10	46	20	12
11	38	21	10.5
12	32	22	9.5
13	27	23	8.5
		24	8.0

TABLE FOR COMPUTING ROTTEN OR CULLED WOOD.

One stick 4" diameter = .0035 cords
" " 5 " " .0055 "
" " 6 " " .0078 "
" " 7 " " .0106 "
" " 8 " " .0138 "
" " 9 " " .0175 "
" " 10 " " ·0209 "
" " 11 " " .0263 "
" " 12 " " .0312 "
" " 13 " " .0370 "
" " 14 " " .0417 "
" " 15 " " .0476 "
" " 16 " " .0555 "
" " 17 " " .0625 "
" " 18 " " .0714 "
" " 19 " " .0769 "
" " 20 " " .0833 "
" " 21 " " .0952 "
" " 22 " " .105 "
" " 23 " " .117 "
" " 24 " " .125 "

MEASUREMENT TABLES. After a complete record of a car is made as above, the total gross contents of wood contained therein is figured from the



PROPERLY LOADED 36 FOOT PULPWOOD CARS.

dimensions obtained, the calculations being extended to two decimal places. For this purpose very complete tables have been prepared, being added to from time to time since they were started eighteen years ago, so that now they contain the result in cords of practically every size tier which can be piled in a car. The use of these tables saves a great deal of time to the scaler and also insures accuracy in extensions. After the gross cords are obtained, deductions are made for underlengths, rotten wood, knotty wood and foreign wood, which gives the net cords of merchantable pulpwood contained in the car and completes the scale.

ACCURACY OF SURVEYING METHOD. We have had shippers who claimed that because a car was of a certain size they should therefore receive credit for the number of cords it would contain based on the car space, but the Company does not buy car space, and by the above method of scaling each tier separately, has no trouble in proving the accuracy of results it obtains for each car received.

Co-operation.

By Frank W. Farrington.

FROM his rolling vintage Father Time has pressed another year, and again we gather to congratulate each other and ourselves individually that we are still component elements of the active force of the Berlin Mills Company.

The year has reached a point between the green of summer and the white of winter—when chill November's surly blasts are a reminder that we must soon expect a long visit from Jack Frost, Santa Claus, Boreas and all those old fellows who regularly come once a year.

Still as we assemble here, notwithstanding the bluster and inclemency that put themselves in evidence outside, we are impressed with the idea that:

"Its always fair weather
When good fellows get together
With a Stein on the table
And a good song ringing clear!"

While that stanza is outwardly the expression of joviality and enjoyment of youth, there is a sentiment that applies to the present occasion—"When good fellows get together." And we want to emphasize the idea of getting together.

Getting together is the motive force that has made this corporation the stupendous business and industrial enterprise that it is today. Team work is recognized as a pre-requisite in every enterprise that is undertaken whether it be college sport or industrial pursuit. And this fact is nowhere more fully realized than by the management of the Berlin Mills Company.

For ages humanity has sing-songed the nursery rhyme "All work and no play makes Jack a dull boy," but no employer—individual, partnership or corporation has thought to make practical application of the idea to their wage earners until very recent years; and it is to be further noted that nowhere is the idea more fully carried out than by the corporation with which we are associated.

To hark back to the days when "Ki" Winslow built the first mill where the Berlin Mills saw mill now stands, the object in employing men was to get the utmost available work out of them, and when one was disposed of another would take his place.

With the change of ownership of the property came a change in conditions for the men. While it did not receive that name it became, in a measure, a co-operative institution.

A large measure of the energy of the late father of the present manager was devoted to improvements as much for the benefit of the employees as for more economic operation of the plant. More comfortable and more sanitary conditions were sought and installed, and his activities did not stop with the industrial relations, but also covered a broad field of social conditions.

And we have constantly before our eyes in the Young Men's Christian Association building a monument to his philanthropic nature, and to his far sightedness in making the public an interested partner in the organization.

And while we may regard this building as an outward and visible monument to the memory of William W. Brown, each of us who had the pleasure and honor of personal relations with him, has in his own heart a monument in the sacred memories of his kindness of heart and generosity of spirit.

And the present management is in no whit backward in its relations with the wage earners who find employment here. When good fellows get together it is not only because they are good fellows, but also because there is something that attracts them one to another. There is a cohesive force of goodfellowship that has its origin in a singleness, a oneness of aim and purpose.

The present management has done much to foster and encourage this aim and purpose, and the result is most gratifying to the employees as we trust it is to the management.

Few are the corporations that make the provision that the Berlin Mills Company have made for the entertainment of their employees, both instructive and recreational, and for healthful sports, such as the encouragement of rifle practice at the Horn Farm, and this annual feast is a potent factor in the promotion and maintenance of good fellowship and co-operation in the performance of the duties of our several positions.

And while we take pride in the results shown by "team work" we must not lose sight of the fact that team work is impossible without a guiding hand to direct the movements of the entire team as by a common impulse and in this particular feature the Berlin Mills Company is singularly fortunate in having thoroughly efficient guidance in the person of Mr. W. R. Brown, whom we take pleasure in holding in the highest respect, esteem and affection.

Woods Department.

RESULTS OF SHOOTING CONTEST AT MAYNESBORO STOCK FARM, BERLIN, N. H., NOVEMBER 24, 1915.

ONE HUNDRED YARDS.

UNITED STATES.

		POINTS	TOTAL
1	P. W. Churchill	10-10-10-10-9-9-9-8-8-7	90
2	A. L. Bowker	10-10- 9- 9-9-8-8-8-8-7	86
3	J. J. Delaney	10- 9- 9- 9-9-8-8-8-8-7	85
4	G. E. Anderson	10- 9- 9- 8-8-8-8-7-5-3	75
5	W. R. Brown	10-10- 9- 7-7-7-7-6-5-3	71
6	J. J. Lumm	10- 9- 8- 6-6-6-6-6-6-6	69
7	F. W. Thompson	10-10- 8- 8-7-6-4-4-3-3	63
8	J. E. Laffin	9- 8- 9- 7-7-6-5-5-4-3	63
9	A. E. Rowell	9- 9- 9- 7-6-6-5-4-4-3	62
10	H. H. Hindle	9- 8- 7- 6-6-6-5-5-4-4	60
11	F. C. King	9- 8- 8- 7-7-6-5-4-3-3	60
12	H. S. Gregory	10-10- 9- 8-7-5-3-3-3-2	60
13	W. D. Bryant	8- 8- 7- 6-5-5-5-4-4-3	55
14	F. W. Farrington	9- 8- 6- 6-5-5-5-4-4-3	54
15	W. L. Bennett	10- 8- 7- 7-5-5-3-3-2-2	52
16	A. M. Carter	10- 8- 7- 6-5-4-4-3-3-0	50
17	G. A. Horne	9- 7- 6- 6-6-4-3-3-3-3	50
18	W. B. Brockway	8- 8- 6- 6-5-4-3-3-3-3	49
19	Alphonso Curtis	10- 8- 7- 7-4-3-3-3-2-0	47
20	S. S. Lockyer	7- 7- 5- 4-3-3-3-3-3-3	41
21	D. J. Horan	9- 8- 7- 5-3-3-3-0-0-0	38
22	J. S. Mooney	7- 6- 4- 3-3-3-3-3-3-3	38
23	J. F. Heck	7- 6- 5- 3-3-3-3-3-2-2	37
24	James Keenan	7- 7- 5- 3-3-2-2-2-2-2	35
25	H. B. Curran	6- 6- 5- 5-4-3-3-3-0-0	35
26	Wm. Mahaney	7- 5- 3- 3-3-3-3-2-2-2	33
27	W. H. Morrison	5- 5- 4- 3-3-3-3-3-2-2	33
28	J. W. Peterson	8- 5- 3- 3-3-3-3-0-0-0	28
29	D. W. Linton	3- 2- 2- 2-2-0-0-0-0-0	11
	Total		1530

CANADA.

		POINTS	TOTAL
1	T. E. Mack	10-10-10-9-9-9-8-7-6-5	83
2	J. C. Corbett	10-10-10-9-7-7-7-6-6-5	77
3	Fred Gilman	10 10- 9-9-9-7-6-6-5-5	76
4	J. A. Taylor	10- 9- 9-9-8-7-7-6-6-5	76
5	J. H. Carter Jr.	9- 8- 9-8-8-7-7-6-5-4	71
6	P. P. Cole	10- 9- 8-8-7-7-7-6-5-3	70
7	C. J. Prarie	9- 9- 9-8-7-6-6-5-3-3	65
8	S. Redmond	10- 8- 8-8-7-6-5-4-4-3	63
9	H. L. Bradbury	9- 8- 7-7-6-6-6-5-5-3	62
10	J. E. Robichaud	10- 9- 8-7-6-6-4-3-3-3	59
11	A. L. Laferriere	10- 9- 7-7-6-5-4-4-3-3	58
12	S. L. de Carteret	9- 9- 8-6-5-5-4-3-3-3	55
13	P. J. Prince	8- 8- 7-7-5-5-3-3-3-3	52
14	R. J. Sawyer	10- 8- 8-5-3-3-3-3-2-0	45
15	A. W. Martin	9- 8- 6-6-4-3-3-2-2-2	45
16	C. B. Bradley	8- 8- 7-5-4-3-3-2-2-0	42
17	L. P. Jutras	8- 7- 4-3-3-3-3-3-3-3	40
18	R. J. Barbin	6- 5- 5-4-4-4-3-3-3-2	39
19	D. P. Brown	9- 7- 5-5-3-3-2-2-0-0	36
20	J. H. Page	8- 4- 4-3-3-3-3-3-3-2	36
21	J. V. Perrin	8- 6- 3-3-3-3-3-2-2-2	35
22	Ed. R. Linn	8- 5- 5-3-3-3-3-2-2-0	34
23	P. B. Keens	7- 5- 5-4-3-2-2-2-2-2	34
24	Simmons Brown	9- 6- 4-3-3-3-3-2-0-0	33
25	L. C. Allaire	7- 6- 3-3-3-3-2-2-2-0	31
26	J. W. Marcotte	7- 3- 3-3-3-3-3-3-3-0	31
27	Jos. Gosselin	7- 5- 4-3-2-2-2-0-0-0	25
28	W. J. Brady	9- 3- 3-3-3-3-0-0-0-0	24
29	J. S. Cassidy	4- 3- 3-3-2-2-2-2-2-0	23
	Total		1420

TWO HUNDRED YARDS.

UNITED STATES.

				TOTAL
1	A. L. Bowker	8-8-7-8-7-7-5-6-6-4	66	152
2	P. W. Churchill	10-8-7-7-7-6-5-5-4-4	63	153
3	W. R. Brown	9-9-8-8-7-7-4-3-3-3	61	132
4	F. C. King	8-7-6-5-5-5-4-3-3-3	49	109
5	A. E. Rowell	10-6-4-3-3-3-3-3-3-2	40	102
6	G. E. Anderson	6-6-5-4-3-3-3-3-3-2	38	113
7	F. W. Thompson	10-6-6-3-3-2-2-3-0-0	35	98
8	H H. Hindle	8-7-5-3-3-3-2-2-0-0	33	93
9	J. J. Delaney	5-5-4-3-3-3-3-2-2-2	32	117
10	J. E. Laffin	5-4-3-3-3-3-2-2-2-2	29	92
	Total		446	

CANADA.

				TOTAL
1	Fred Gilman	9-9-7-7-7-7-7-5-2-2	62	138
2	J. A. Taylor	10-7-7-7-5-4-4-3-3-3	53	129
3	J. C. Corbett	10-7-4-4-3-3-3-3-3-3	43	120
4	T. E. Mack	8-7-6-4-3-3-3-3-3-3	43	126
5	J. H. Carter Jr.	9-8-5-5-3-3-3-3-2-2	43	114
6	H. L. Bradbury.	5-5-5-5-4-4-4-3-3-3	41	103
7	C. J. Prarie	9-8-6-6-3-3-2-0-0-0	37	102
8	P. P. Cole	6-5-4-3-3-3-3-3-2-0	32	102
9	J. E. Robichaud	6-2-2-2-2-2-0-0-0-0	16	75
10	S. Redmond	2-2-2-2-0-0-0-0-0-0	8	71
	Total		378	

	TOTAL 100 YDS.	TOTAL 200 YDS.
United States	1530	446
Canada	1420	378
Difference	110	68

PRIZE WINNERS.

	TOTAL SCORE 100 and 200 YDS.
1st, P. W. Churchill, U. S.	153
2nd, A. L. Bowker, U. S.	152
3rd, Fred Gilman, Can.	138

UNITED STATES TEAM, WINNERS OF THE SHOOTING CONTEST

RIFLE CONTEST PRIZE WINNERS

P. W. CHURCHILL, 1st

A. L. BOWKER, 2d FRED GILMAN, 3d

Attendance.

NAME	POSITION	COMPANY	ADDRESS
Allaire, L. C.	Local Manager	Brown Corporation	Moulin Beaupre, P. Q.
Adams, F. C.	Salesman	Clyde Iron Works	New York City
Anderson, G. E.	Scaler	Berlin Mills Co.	Berlin, N. H.
Barbin, R. J.	Bookkeeper	Brown Corporation	Notre Dame du Rosaire, P. Q.
Bennett, W. L.	Bookkeeper	Brown Corporation	Berlin, N. H.
Bowker, A. L.	Storehouse Manager	Berlin Mills Co.	Millsfield, N. H.
Bradbury, H. L.	Bookkeeper	Brown Corporation	St. Raymond, P. Q.
Bradley, C. B.	Draftsman	Brown Corporation	La Tuque, P. Q.
Brady, W. J.	District Manager	Brown Corporation	St. George, Beauce, P. Q.
Brown, D. P.	District Manager	Brown Corporation	La Tuque, P. Q.
Brown, Simmons	Purchasing Agent	Brown Corporation	Quebec, P. Q.
Brown, W. R.	General Manager	All Companies	Berlin, N. H.
Brockway, W. B.	Comptroller	Berlin Mills Co.	Portland, Maine.
Bryant, W. D.	Bookkeeper	Berlin Mills Co.	Berlin, N. H.
Carter, H. F.	Timber Estimator	Berlin Mills Co.	Berlin, N. H.
Carter, A. M.	Timber Estimator	Berlin Mills Co.	Berlin, N. H.
Carter, J. H., Jr.	Inspector	Brown Corporation	La Tuque, P. Q.
Cassidy, J. S.	Local Manager	Brown Corporation	Bromptonville, P. Q.
Churchill, P. W.	General Office Manager	Berlin Mills Co.	Berlin, N. H.
Cole, O. P., Major	Paymaster	Berlin Mills Co.	Berlin, N. H.
Cole, P. P.	Inspector	Brown Corporation	La Tuque, P. Q.
Coleman, N. H.	Surveyor	Brown Corporation	La Tuque, P. Q.
Cox, J. T.	Mgr. Kream Krisp Plant	Berlin Mills Co.	Berlin, N. H.
Corbett, J. C	Local Manager	Beaurivage Lumber Co	Craigs Road, P. Q.
Curran, H. B.	Bookkeeper	Fitzgerald L. & L. Co.	Berlin, N. H.
Curtis, Alphonso	Head Scaler	Berlin Mills Co.	Berlin, N. H.
De Carteret, S. L., C. E	Local Manager	Brown Corporation	St. Raymond, P. Q.
Delaney, J. J.	Walking Boss	Berlin Mills Co.	Berlin, N. H.
Farrington, F. W.	Scaler	Brown Corporation	Berlin, N. H.
Ford, Ellery	Mill Superintendent	Brown Corporation	St. Marie, Beauce, P. Q.
Gibbons, Ed.	Veterinary	Berlin Mills Co.	Berlin, N. H.
Gilman, Fred	River Foreman	Brown Corporation	La Tuque, P. Q.
Gosselin, Jos.	Inspector	Brown Corporation	St. George, Beauce, P. Q.
Graff, J. H.	Official Photographer	Berlin Mills Co.	Berlin, N. H.
Gregory, H. S.	General Office Manager	Brown Corporation	Berlin, N. H.
Heck, J. F., B. F.	Forester	Brown Corporation	Berlin, N. H.
Hindle, H. H.	Walking Boss	Berlin Mills Co.	Berlin, N. H.
Hinman, B. H., Lieut.	Attorney		Berlin, N. H.
Horn, George	Walking Boss	Berlin Mills Co.	Milan, N. H.
Horan, D. J.	Inspector	Fitzgerald L. & L. Co.	Johnson, Vt.
Jutras, L. P.	Bookkeeper	Brown Corporation	Lyster, P. Q.
Keens, P. B.	Bookkeeper	Brown Corporation	Moulin Beaupre, P. Q.
Keenan, James	District Manager	Fitzgerald L. & L. Co.	Island Pond, Vt.
King, F. C.	Storehouse Manager	Berlin Mills Co.	Oquossoc, Maine.
Laferriere, A. L.	Local Manager	Brown Corporation	Victoriaville, P. Q.
Laffin, J. E.	Storehouse Manager	Fitzgerald L. & L. Co.	Island Pond, Vt.
Letson, T. H.	Salesman	American Hoist & Derrick Co.	New York City.
Linn, Ed. R., F. E.	Forester	Brown Corporation	St. George, Beauce, P. Q.
Linton, D. W.	Traffic Manager	Berlin Mills Co.	Berlin, N. H.
Lockyer, S. S., F. E.	Forester	Berlin Mills Co.	Berlin, N. H.
Lumm, J. J.	Sales Manager	Clyde Iron Works	Duluth, Minn.
Mack, T. E.	Purchasing Agent	Brown Corporation	La Tuque, P. Q.

ATTENDANCE—*Continued.*

NAME	POSITION	COMPANY	ADDRESS
Mahaney, Wm.	Head Inspector	Berlin Mills Co.	Berlin, N. H.
Martin, A. W.	Bookkeeper	Brown Corporation	St. George, Beauce, P. Q.
Marcotte, J. W.	Bookkeeper	Brown Corporation	St. George, Beauce, P. Q.
McCrystle, P.	Head Scaler	Brown Corporation	Berlin, N. H.
Mooney, J. S.	Bookkeeper	Berlin Mills Co.	Berlin, N. H.
Morrison, W. H	Secretary	N. H. Timberland Owners Assoc.	Gorham, N. H.
Page, J. H.	Head Scaler	Brown Corporation	La Tuque, P. Q.
Perry, L. I.	Auditor	Niles & Niles	Boston, Mass.
Perrin, J. V.	Local Manager	Brown Corporation	St. Epiphane, P. Q.
Peterson, J. L.	Scaler	Fitzgerald L. & L. Co.	Norton, Vt.
Prarie, C. J.	Mill Superintendent	Brown Corporation	St. Raymond, P. Q.
Prince, P. J.	Head Scaler	Brown Corporation	St. George, Beauce, P. Q.
Redmond, S.	Inspector	Brown Corporation	St. George, Beauce, P. Q.
Robichaud, J. E	Local Manager	Brown Corporation	Notre Dame du Rosaire, P. Q.
Rowell, A. E.	Steam Engineer	Berlin Mills Co.	Berlin, N. H.
Sawyer, R. J.	Storehouse Manager	Brown Corporation	La Tuque, P. Q.
Swan, W. F.	Bookkeeper	Berlin Mills Co.	Berlin, N. H.
Taylor, J. A.	Local Manager	Brown Corporation	Lyster, P. Q.
Taylor, O. F.	Auditor	Niles & Niles	New York City.
Thompson, F. W.	Accountant	Berlin Mills Co.	Portland, Maine.

Index.

Attendance 35
"Co-operation"—Frank W. Farrington 32
"Forest Pathology"—Edward R. Linn 8
"Hardwood"—James W. Keenan 17
"Kraft Paper and Its Uses"—W. R. Brown 5
"Mechanical Log Haulers and Their Development"—Simmons Brown 22
"Pulpwood Loading and Receiving"—Peter McCrystle 27
Results of Shooting Contest 34

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